Origin and early evolution of the Pacific plate from studying Earth's slab graveyard

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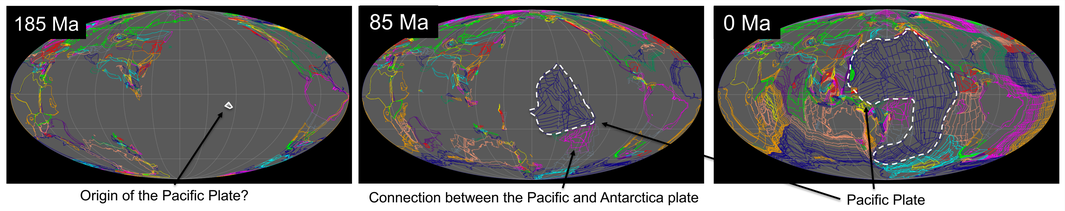
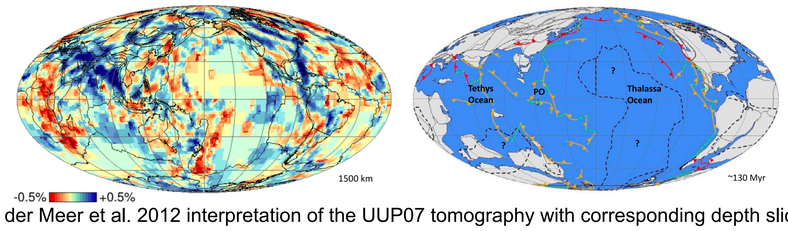
Background



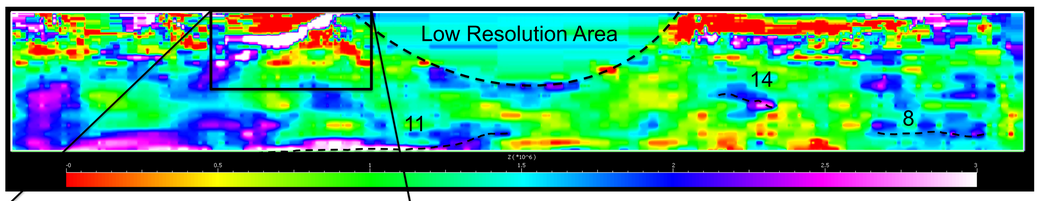
- The Pacific Plate is believed to have originated at 185 Ma
- At 85 Ma the plate has a recorded connection to the Antarctica Plate that solidifies its location that is then tracked through time in respect to neighboring plates with known histories
- The location of the Pacific Plate is largely unknown from 185 Ma to 85 Ma

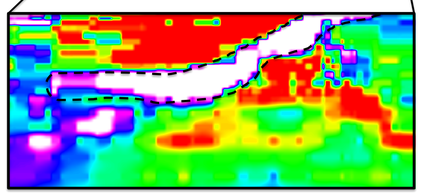


Van der Meer et al. 2012 interpretation of the UUP07 tomography with corresponding depth slices

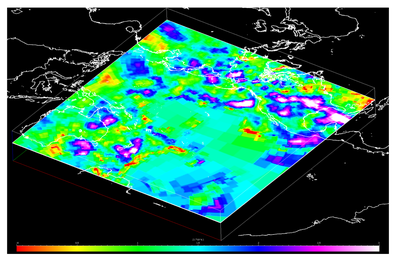
- Fast tomographic anomalies (blue spots) were interpreted as subduction zones

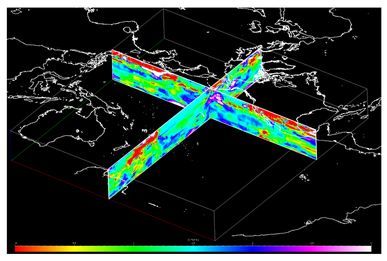
Methodology





- UUP07 tomography shows velocity variations within the Earth's mantle
- High velocity (purple) areas potentially indicate subducted tectonic plates
- Traditional methods of mapping tomography is in 2D depth slices rather than 3D





- Once plates have been found they are imported to GPlates where they are tested against plate reconstructions through time.

References

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Acknowledgments

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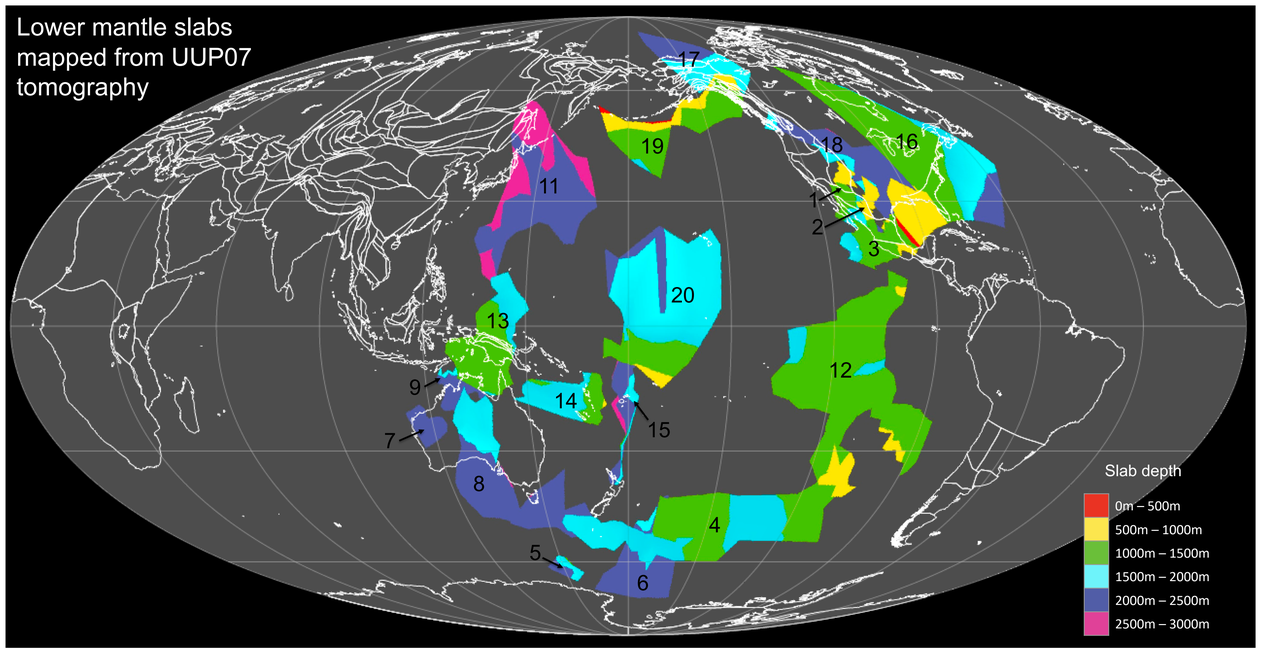
Results: Earth's slab graveyard under the Pacific



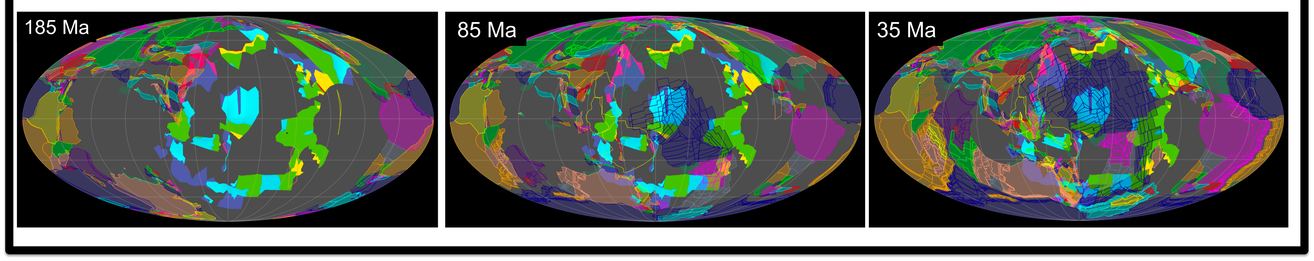
Slab Number	Median depth km	0 MA	25 MA	50 MA	75 MA	100 MA	125 MA	150 MA	175 MA	200 MA	225 MA	250 MA
2	1,067											
19	1,132											
3	1,245											
12	1,288											
13	1,421											
1	1,511											
16	1,533											
14	1,687											
4	1,752											
20	1,932											
5	2,086											
17	2,108											
8	2,350											
18	2,351											
15	2,462											
7	2,483											
9	2,483											
6	2,505											
11	2,726											

Plate is more than or equal to 75% visible (i.e. no overlaps) within a plate reconstruction*

Plate is less than 75% visible (i.e. nearly vanished from Earth's surface)

Muller et al. 2016, Matthews et al. 2016, Wu et al., 2016, and the Wu group (2018)

- Slabs are numbered and median depth was calculated
- The slabs were then compared with time dependent files of accepted plate movement
- The plate was tested on a pass or fail test based on whether 75 percent of its body was visible
- Before 100 million years the predicted plates were viable
- At around 100 million years and after the plates were somehow subducted under the expanding Pacific, and other oceanic basins and continents.



Conclusions

- These plates have a wide array of depths that primarily correspond to long periods of subduction in the paleo-Pacific region prior to 100 million years ago
- The stark change in visibility across the 100 million year time mark indicates a possible increase in plate tectonic activity (i.e. a plate reorganization) in the paleo-Pacific region